Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	**)**
	)
ROBERT BOSCH LLC	**)**
	)
Request for Waiver of Section 15.245 of the	**)**
Commission's Rules to Permit the Marketing,	**)**
Sale and Operation of an Active Parking Lot	**)**
Management (Occupancy) Sensor	**)**

To: The Chief, Office of Engineering and Technology
Via: Office of the Secretary

REQUEST FOR WAIVER

Robert Bosch LLC (Bosch), by and through counsel and pursuant to Sections 1.3 and 1.925 of the Commission's Rules (47 C.F.R. §§ 1.3 and 1.925), hereby respectfully requests that the Commission waive a portion of Section 15.245(b) [47 C.F.R. §15.245(b)] of the Commission's Rules governing the operation of intentional radiators in, *inter alia,* the band 2400-2483.5 MHz, which are used as field disturbance sensors. The requested waiver would permit Bosch to have certified under the Commission's Equipment Authorization program; to market and sell in the United States; and for its customers to operate, a low-powered Parking Lot Occupancy Sensor (PLS sensor), which will be a component of a parking lot management system. The sensor device in question necessitates an occupied bandwidth of 80 megahertz in the band 2400-2483.5 MHz, but this bandwidth is not permitted for radiodetermination devices in the entirety of that band in the United States, pursuant to Section 15.245(b) of the Commission's Rules. Instead, only the frequency range 2435-2465 MHz is available pursuant to that rule section for such devices. Operation of the sensor device should have no adverse effect on licensed or

unlicensed terrestrial telecommunications systems and facilities (individually or in terms of aggregate noise levels). However, among other benefits, this sensor and the parking lot management system into which it will be integrated will save time and effort for motorists in searching for an open parking space, long before arriving at the parking lot. In the interest of the public in deploying this new and useful technology in the United States, and in support of the instant waiver request, Bosch states as follows:

I. Introduction

1. Bosch, a leading global supplier of technology and services, manufactures, among many other products, high-quality sensors for incorporation in composite devices. Bosch has developed a PLS sensor device for use by integrators and parking lot operators in a system which supports the allocation and indication of available parking spaces for automobiles, and which minimizes traffic within a parking lot or garage.[1] Use of this system will reduce the time and energy of drivers which is now wasted looking for available parking spaces. The system will incorporate the small Bosch PLS sensor that is the subject of this waiver request in each parking space in a lot. It will detect the current occupancy status of each space. The sensors communicate that data to a gateway. The gateway sends data analytics to the Cloud via Internet and then, via an application, to drivers' mobile devices or those in their vehicles, directing the driver to the nearest open and available parking spaces as they approach the parking lot.

[1] The sensor is integrated in systems which utilize protocols which are standardized by the LoRa Alliance to provide easy access to this new technology.

2. The sensors contain a LoRa[2] communication module which operates in the 902-928 MHz band in accordance with all current Part 15 rules. The LoRa module, which is used to communicate with the gateway, is in compliance with all applicable Part 15 regulations. The PLS sensor also, however, includes a radiodetermination component which operates in the 2.45 GHz range. For several reasons (including issues related to reflection coefficient of objects; distances to objects; battery life and cost of hardware) the optimum band for the radiodetermination component of the sensor is the 2400-2483.5 MHz band. The requirement for the sensor's radiodetermination function is an occupied bandwidth of 80 megahertz in the band 2400-2483.5 MHz, and a power level of -10 dBm/MHz (e.i.r.p.). This translates to the very minimal field strength of 1.8 mV/m measured at 3 meters from the sensor. In addition to the radar function of the sensor, there is an inductive sensor integrated into the PLS sensor such that, should the inductive sensor detect changes, the radar will be activated (in addition to a measurement every ten minutes).

3. The radar portion of the sensor utilizes 8 frequencies within the band 2400-2483.5 MHz (centered at 2.45 MHz). The transmitter signal timing per frequency using stepped modulation is 37.5 µs, and the time duration for one complete sequence (one transmitted signal) is 8 milliseconds. One measurement has a transmit duration of, at most, 32 milliseconds. The overall duty cycle of the device is four transmitted signals every ten minutes. Thus, the duty cycle in the worst case is less than 1%.

[2] LoRa is a long-range wireless communication protocol using spread spectrum modulation, typically operating at 902-928 MHz in North America, which features extremely long range connectivity at a relatively low data rate.

4. The Commission's rule providing for unlicensed operation of radiodetermination devices (intentional radiators) in this frequency range is Section 15.245. That rule reads, in relevant part, as follows:

§ 15.245 Operation within the bands 902-928 MHz, 2435-2465 MHz, 5785-5815 MHz, 10500-10550 MHz, and 24075-24175 MHz.
(a) Operation under the provisions of this section is limited to intentional radiators used as field disturbance sensors, excluding perimeter protection systems.
(b) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (millivolts/meter)
902-928	500	1.6
2435-2465	500	1.6
5785-5815	500	1.6

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The rule does not accommodate the Bosch device because of the frequency range permitted in the 2.4 GHz band. The available bandwidth under this subsection for intentional radiator field disturbance sensors is only 30 megahertz and as noted above, 80 megahertz is required for this device to work. The principal reason for this is that an 80 megahertz occupied bandwidth is necessary in order to achieve the necessary detection probability, and also to detect different automobile construction materials (which increasingly include carbon fiber, various plastics and other non-metallic construction components).[3] The apparent basis for the frequency range limitation is to ensure against out-of-band emissions beyond the range 2400-2483.5 MHz, and since the Bosch sensor uses a *fundamental* frequency field strength of only 1.8 mV/m measured at 3 meters from the device (whereas 500 mV/m on fundamental frequencies and 1.6 mV/m is permitted

[3] Another reason for the wider bandwidth is that frequency diversity is needed to minimize interaction between the emitted and reflected radar signals.

for harmonics are permitted by the rule), it is apparent that the device will have negligible interference potential, either in-band or out-of-band. The device will operate well below the specified out-of-band emission limit outside its operating bandwidth.

5. Other rule sections in Part 15 which accommodate intentional radiators in the band 2400-2483.5 MHz are unavailing for more basic reasons. Section 15.247 of the Rules, which permits intentional radiators in the entire band 2400-2483.5 MHz limits operation under the provisions of that Section to frequency hopping and digitally modulated intentional radiators. The rule is not intended to apply to field disturbance sensors such as the Bosch PLS device. Furthermore, the Bosch device cannot comply with the hopping parameters specified in Section 15.247(a)(1)(i-iii), in terms of the minimum number of steps permitted by the rule. Nor can Bosch avail itself of Section 15.249 which applies to high-power point-to-point communications using directional antennas. Of the three rules from which Bosch could choose to seek a waiver, the most appropriate rule to be applied to this device is Section 15.245(b), since the only portion of that rule that calls for a waiver is the provision pertaining to the occupied bandwidth in the band 2400-2483.5 MHz. Section 15.245 permits the use case at issue, and the Bosch sensor device operates at well below the permitted fundamental and harmonic limitations, and applicable out-of-band emission limitations.

II. Waiver Standards

6. The Commission may waive a rule for good cause shown. 47 C.F.R. § 1.3. Waiver is appropriate if special circumstances warrant a deviation from the general rule and such deviation would better serve the public interest than would strict adherence to the general rule. *Northeast Cellular*, 897 F. 2d 1164, 1166 (D.C. Cir. 1990). Generally,

the Commission may grant a waiver of its rules in a particular case if the relief requested would not undermine the policy objective of the rule in question and would otherwise serve the public interest. *WAIT Radio v. FCC*, 418 F2d 1153, (DC Cir 1969); *Dominion Video Satellite, Inc., Order and Authorization*, 14 FCC Rcd. 8182 (Int'l Bur. 1999). In *WAIT Radio*, it was held that even if the overall objectives of a general rule have been adjudged to be in the public interest, it is possible that application of the rule to a specific case may not serve the public interest if an applicant's proposal does not undermine the public interest policy served by the rule. 418 F. 2d at 1157. In discussing the treatment of requests for waivers of established rules, the court in *WAIT Radio* emphasized that the agency's discretion in applying general rules is intimately linked to the existence of "a safety valve procedure" to permit consideration of an application for exemption based on special circumstances. *Id*. Indeed, the court considered a rule most likely to be undercut if it does not take into account "consideration of hardship, equity, or more effective implementation of overall policy…" *Id*. at 1159. The Commission's waiver authority, per Section 1.925 of the Commission's Rules, 47 C.F.R. § 1.925, allows the Commission to grant a waiver if it is shown that (a) the underlying purpose of the rule(s) would not be served or would be frustrated by application to the instant case, and grant of the requested waiver would be in the public interest; or (b) if there are unique or unusual factual circumstances in a specific case where application of the rule would be inequitable, unduly burdensome or contrary to the public interest, or the applicant has no reasonable alternative. In this case, the latter rationale is specifically applicable to the Bosch PLS sensor product. The frequency limitation applicable to the band 2400-2483.5 MHz, limiting the fundamental frequency range to only 2435-2465 MHz assumes that all field

disturbance sensors can operate effectively in an occupied bandwidth of not more than 30 megahertz. The Bosch PLS sensor, a periodic intentional radiator with a low duty cycle and an exceptionally low power level, must have an 80 megahertz occupied bandwidth in order to function reliably and to accurately sense empty parking lot spaces, given distances to objects and the reflection coefficient of objects. There is no possibility that this device could be reconfigured to comply with the frequency limitations in this rule and still function accurately without incurring risk of false indications. There is no other rule that would permit the device to operate, and the rule in question is the appropriate rule for regulating field disturbance sensors such as the Bosch PLS sensor. It can and should be authorized in the public interest, and it can be operated without risk of interference to licensed radio services and other Part 15 devices, both inside and outside the requested frequency range, due to the extremely low operating power level and the low duty cycle.

III. Conclusions and Request for Waiver

7. Bosch requests that the Commission waive, for the Bosch PLS Sensor and for functionally identical versions of that sensor, the requirement in Section 15.245(b) of the Commission's Rules applicable to intentional radiators in the band 2400-2483.5 MHz, to the extent necessary to permit Bosch to obtain a grant of equipment authorization (Certification) for its parking lot sensor, operating in that entire frequency range, rather than in the band 2435-2465 MHz permitted by the rule sought to be partially waived. Bosch accepts that this waiver might be conditioned on the absence of reported and unresolved interference to licensed services in the subject frequency band, and Bosch will

include any necessary interference resolution obligations in the installation and operating instructions distributed with the product in the United States.

Therefore, the foregoing considered, Bosch respectfully requests that the Commission grant to it a waiver of Section 15.245(b) [47 C.F.R. §15.245(b)] of the Commission's Rules governing the operation of intentional radiators in the band 2400-2483.5 MHz, devices, so as to permit Bosch to market and sell, and for its customers who operate parking lots and parking garages to operate, the Bosch PLS sensor, and functionally identical future versions of the product marketed by Bosch in the United States.

Respectfully submitted,

ROBERT BOSCH LLC

By: Ana Meuwissen
Ana Meuwissen, Director
Federal Government Affairs

Robert Bosch LLC
1455 Pennsylvania Avenue, N.W.
Suite 755
Washington, D.C. 20004
Ana.Meuwissen@us.bosch.com

By: Christopher D. Imlay
Christopher D. Imlay
Communications Counsel

Booth, Freret & Imlay, LLC
14356 Cape May Road
Silver Spring, Maryland 20904-6011
(301) 384-5525 telephone
chris@imlaylaw.com

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